

R E P O R T R E S U M E S

ED 016 473

JC 670 981

THE MORE-THAN-TWO-YEAR JUNIOR COLLEGE PROGRAM IN CALIFORNIA.
CALIFORNIA STATE COORD. COUNCIL FOR HIGHER EDUC.

PUB DATE OCT 67

EDRS PRICE MF-\$0.25 HC-\$0.92 21P.

DESCRIPTORS- *JUNIOR COLLEGES, *ENGINEERING TECHNICIANS,
VOCATIONAL EDUCATION, *TECHNICAL EDUCATION,
*SUBPROFESSIONALS, CURRICULUM PLANNING, CURRICULUM
DEVELOPMENT, *PROGRAM LENGTH, ENGINEERING EDUCATION,

TECHNICIAN COURSES ARE GENERALLY REGARDED AS 72-76 SEMESTER-UNIT PROGRAMS, POSSIBLY REQUIRING MORE THAN THE CUSTOMARY TWO YEARS, DEPENDING ON HOW MANY HUMANITIES OR BUSINESS COURSES ARE INCLUDED TO BALANCE EDUCATION WITH TRAINING AND ON HOW MUCH REMEDIAL WORK IS NEEDED. ALTHOUGH NO CLEAR TRENDS ARE YET APPARENT TOWARD EXTENDING THE TYPICAL 2-YEAR COLLEGE PROGRAM, CERTAIN FACTORS ARE CONTRIBUTING TO A GRADUAL EXTENSION OF THE ENGINEERING TECHNICIAN PROGRAMS, EVEN, IN A FEW CASES, TO FOUR YEARS. THIS TENDENCY IS ENCOURAGED BY THE EFFORTS OF ACCREDITING AGENCIES, PROFESSIONAL GROUPS, AND STATE AND FEDERAL LICENSING AGENCIES TO UP-GRADE PARTICULAR OCCUPATIONS. THE PROCESS IS COMPLICATED, HOWEVER, BY THE FAILURE OF INDUSTRY TO PROVIDE AN EXACT JOB DESCRIPTION FOR A TECHNICIAN OR A PRECISE STATEMENT OF EITHER ENTRY-LEVEL OR SUBSEQUENT UP-GRADING REQUIREMENTS. WITH THE GROWING DIVERSITY OF ENGINEERING SPECIALTIES, INDUSTRY CAN USE MORE GRADATIONS IN TRAINING. THE EDUCATOR, THEREFORE, BEING AWARE OF THE DIFFERENCES IN THE VARIOUS LEVELS OF TRAINING, CAN GUIDE THE STUDENT INTO A CURRICULUM APPROPRIATE TO THE JOB NEEDS AND TO HIS OWN APTITUDES. (HH)

ED016473

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE
PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS
STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION
POSITION OR POLICY.

THE MORE-THAN-TWO-YEAR
JUNIOR COLLEGE PROGRAM IN CALIFORNIA

☐ Coordinating
☐ Council for
☐ Higher
☐ Education

67-14
A Staff Report for
Presentation to the
Council on
October 30-31, 1967

JC 670 981

Introduction

Background

The Council, in an action of November 29, 1966, concerning studies pertaining to the delineation of functions, directed the staff to undertake "A study of the three-year programs in the Junior Colleges which are necessary in awarding certificates in certain technical areas."

Initial review of the subject indicated that the problem was three-fold: (1) to identify Junior College curricula which now are a three-year term or are approaching this length, (2) to consider trends toward such extended curricula and the influences at work contributing to such extensions, and (3) to assess the need for further studies of the problem.

This report has depended most heavily upon the findings of unstructured interviews. Individuals have been contacted in California Junior Colleges, Junior College associations, as well as other persons conversant with problems in the field. Some effort has been made to determine national trends through contact with persons now responsible for national programs, or recently in that position. The Council's Washington representative has participated in gathering material for the survey. A list of persons interviewed is shown in Appendix A.

Focus of the Report

The material following relates primarily to technical, normally non-transfer curricula offered by Junior Colleges. By definition, it is assumed that all transfer curricula will continue to be designed as a two-year bloc to parallel the freshman and sophomore years in a four-year college. (Similarly, it is assumed that those liberal or general education curricula patterns for non-transfer and non-occupationally-oriented Junior College students will continue to be organized to extend over a two-year period or less.)

There is no generally agreed upon definition of "technical education", "technician training" or the like. Further, the distinction between vocational, on the one hand, and technical, on the other, is not easily made. Most writers who seek to distinguish terms suggest that vocational-technical education (or curricula) be viewed on a continuum where vocational training emphasizing manipulative skills is at one end and technical training which is concept-oriented is at the other. The step beyond the "technical" end of this continuum is the professional level.

Though no precise definitions are accepted by all Junior Colleges, technical education might be described by the following statements:

1. It emphasizes work in the field of science, health, and mathematics and often is related to industry or engineering.

2. It gives much attention to technical knowledge and general education, but also stresses practice and skill in the use of tools and instruments.
3. It leads to competence in one of the technical occupations, and usually to the granting of an associate degree and/or certificate.
4. It includes a core of general education courses up to perhaps one-fourth of the total credit hours.

For the purpose of this report the terms "technical education," "technician" and "technology," and the like, are used to refer to a particular grouping of occupational training, or so-called technical job families within Junior College curricula. These technician training programs tend to fall within the categories suggested in Chart I.

CHART I
TECHNICAL OCCUPATIONS BY
JOB FAMILIES¹

ENGINEERING AND INDUSTRY RELATED

Mechanical Technologies

Air Conditioning/Refrigeration
Aviation/Missile Technology
Automotive Technology
Diesel Technology
Foundry Technology
Hydraulics Technology
Machine Drafting
Operating Engineering
Tool and Die Technology

Civil Technologies

Architectural Drafting
Building Construction Technology
Concrete Technology
Map Drafting
Materials Testing
Sanitation Technology
Structural Technology

Electrical Technologies

Communications Electronics
Computer Electronics
Electrical Power Technology
Electronic Assembly
Electronic Drafting
Industrial Electronics
Missile Electronics

Industrial Technologies

Ceramics Technology
Chemical Technology
Forest Products Technology
Metallurgical Technology
Optical Technology
Paint Manufacturing Technology
Petroleum Technology

¹As suggested by Norman C. Harris in "The Community College and Middle Manpower," Technical-Vocational Education and the Community College, (Williamsburg, VA: Southern Regional Education Board, August, 1964), 15-35. Not all job classifications are necessarily listed under each family, nor are all possible job families listed.

OTHER FIELDS

Technicians in Basic Research

Biological Technician
Bio-Physical Technician
Chemical Technician
Geophysical Technician
Hydrographic Technician
Mathematics Aide
Metallurgical Technician
Meteorological Technician
Physics Research Technician
Spectroscopy Technician

Technicians in the Health Field

Dental Assistant
Dental Laboratory Technician
Histologic Technician
Medical Laboratory Technician
Medical Office Assistant
Medical Records Technician
Psychiatric Technician
Radioisotope Technician
Registered Nurse
X-ray Technician

Business Related Occupations

Bookkeeper-Accountant
Business Data Programmer
Buyer (Retail Store)
Data Processing Technician
Graphic Arts Technician
Legal Secretary
Medical Secretary
Private Secretary
Real Estate Salesman
Store Manager
Sales and Advertising

Exact data are not available to indicate the number of students pursuing technical curricula in junior colleges such as those listed in Chart I. A fall 1966 survey of the State Department of Education did disclose some 2,245 Junior College graduates in the period July 1, 1965-June 30, 1966 were majors in trade and technical occupational training. Another 426 graduates were reported in occupation-centered engineering programs and some 1,200 graduates were reported in health-related technologies. (A total of 29,184 graduates were reported from all curricula.)

A breakdown of fall 1966 enrollments by selected "technical" curricula show the following:

STUDENT MAJORS IN GRADED
J.C. CURRICULA
FALL 1966
SELECTED TECHNICAL SUBJECTS

Health Related

Nursing (A.A.) 4,679
Dental Asst. 2,191
Med. Lab. Tech. 441
Med. Asst. 1,146
X-ray Tech. 614

Engineering Related

Engineering
(Occupational Curricula) 4,682

Other Trade-Technologies

Occupational Training 30,074

While the above are not exact data, they do indicate the substantial numbers of students engaged in technical curricula in California public Junior Colleges.

Need for Extended Junior College Curricula

Where is There Need for Extension?

Extension of Junior College curricula in given areas significantly beyond the two-year pattern or norm does not appear to be of major concern to most Junior College persons or experts in vocational-technical education. The literature is limited on the subject of three-year programs or other less-than-four-year variations, though three-year or five semester programs are being presented in a number of technical institutes, community colleges and within four-year institutions throughout the country.

Grant Venn, author of Man, Education and Work and now with the Bureau of Vocational-Technical Education, U.S. Office of Education, has observed that (though he is familiar with development of three-year programs) he cannot identify a trend in that direction among the nation's Junior Colleges. In national meetings and conferences the subject does not seem to come under discussion.¹ This conclusion appears to be borne out by statements of Dr. William Shannon, American Association of Junior Colleges (A.A.J.C.), and it appears that at this time the A.A.J.C. does not favor formal recognition of the Junior College as more than a two-year institution.²

There is, however, another position. Norman C. Harris, in reply to questions posed by the Council staff, writes:

Your letter . . . treats an issue, which although it is not yet a critical one, is bound to receive increasing attention as the next decade unfolds. There is indeed nothing magic about "two-year" junior college programs. Many educational and training programs are best structured in a shorter time, from six weeks' duration, to one term or one year. Examples of short-term curriculums are certain trade and industrial programs, data processing, cosmetology, vocational nursing, and food service. Persons whose immediate goal is employment can be and are being trained for many jobs in "less than two-year" post-high school programs.

By the opposite token, a goodly number of semi-professional and technical jobs require a breadth and depth of post-high school education such that it is nearly impossible to bring all the required content into a two-year curriculum. The engineering technologies (civil, mechanical, chemical, metallurgical, electronics, etc.) are good examples of these programs.

¹Report of interview with Dr. Venn by Norman Gould, CCHE staff, June 1967.

²Interview with Dr. Shannon conducted by Norman Gould, April 1967. The AAJC has recently begun an "Occupational Education Project" with goals including "To identify current and future needs in the areas of occupational education . . ." In this survey two of the Projects' staff were consulted about their views on trends. See Kenneth G. Skaggs, Douglas W. Burris and Louis R. Fibel, "AAJC's Occupational Education Project," Junior College Journal, 37 (March 1967).

It is common knowledge that, in junior college settings at least, most students desiring an engineering technology program, have a number of deficiencies which must be made up before they can begin the planned two-year collegiate technical sequence of courses. Even if the deficiency problem did not exist, most technical educators agree that proficiency as a graduate technician requires somewhere around 72-76 semester credit hours of work.

One factor which almost dictates the "extra" 12 to 16 credit hours is the necessity for general education--a core of the liberal arts and humanities to balance education with specialized training.¹

The great majority of persons contacted during the course of this survey identified the engineering technology programs as those most constrained within the norm of a two-year program. Programs in nursing and the health related subjects were cited as well as cases of "more than two-year curricula" in fact. For example, the x-ray technician for professional registry requires a two-year program plus one-year clinical experience. Such statements are borne out by the implications of the literature. Other Junior College persons see need and value as well in the extension of curricula more closely related to skilled trades. A few suggest that the Junior College should not only offer two and three year programs, but should be able to offer four-year technology curricula, perhaps in association with a State College.

What are the forces which may contribute to the need to extend curricula?

The Role of Industry in Determining Need

In most instances Junior College programs in occupational areas are developed in cooperation with industry or other agency representatives. Advisory committees are the usual vehicles in California through which college and community articulate programs. These committees vary in effectiveness in making employer needs known, as do Junior College responses to the expressions of those needs. Ultimately it may be the student who has the greatest impact on curricula as he picks and chooses the curriculum he wants to pursue in terms of his job expectations at the time. The unused curriculum quickly dies.

No clear picture emerges in respect to the potential employer's role in encouraging technical curricula development beyond the two-year term. Findings of a survey of technical institute curricula of some years ago appear to be still applicable today to the general question. The study found in part:

¹Letter dated June 30, 1967.

1. There is a distinctive lack of agreement in industry concerning the exact nature of the proper work of technicians.
2. Industry does not seem to know, in terms of specifics, what actually should constitute a satisfactory technical institute type curriculum.¹

Inherent within the problem is a determination of the minimum skill level required for the job entry level. The problem of over-training for the initial job is undoubtedly present in some instances. Lack of general agreement in industry upon minimum accomplishment to commence a given field of occupation makes for problems in curriculum development. Further, the need for up-grading after initial employment is increasingly a problem for industry and education to consider. Junior Colleges necessarily must be assured the industry clearly recognizes what it requires of the beginner in respect to minimum skills.

The Role of the Accrediting Agency or Association in Extension of Curricula

The demands of accrediting and licensing agencies and professional associations may possibly result in extension of curricula. California Junior Colleges have generally adhered to national policies encouraging regional accrediting associations, rather than accreditation for specialized programs. Nevertheless a particular pattern of curricula suggested by an accrediting, professional group probably has some effect upon curriculum organization. It will certainly have effect if graduates of accredited programs are employed and those of regionally accredited (non-specialized) Junior College programs are not.²

Efforts of associations to register graduates of programs may also dictate in some part the extent of curriculum. As the technologies grow in number and extent, more associations will likely be organized. These will affect training programs in a number of areas.

Licensure

Finally, State licensing agencies have direct impact upon curricula; nursing is a good example. Other health related technicians may be licensed with licensure specifying minimum levels of training--the clinical laboratory technician since 1965 is required to have a baccalaureate degree before being examined.

* * *

The implications of the development of more than two-year Junior College programs can perhaps best be suggested by an examination of trends within the engineering technologies. This example is perhaps most relevant in view of the opinion of most observers; further, the issues are fairly clearly drawn and information is more readily at hand.

¹William G. Torpey, "Adequacy of Technical Institute Curricula", The Journal of Engineering Education, (November 1959), 133.

²To date major accreditation problems have arisen in respect to nursing programs and engineering technology curricula. See Thomas B. Merson, "The Crisis in Accreditation," Junior College Journal, 3 (February 1965), 6-8. The Engineers' Council for Professional Development accredits programs of only one Junior College in California.

The Engineering Technologies

Two Trends: Three Year and Four Year Curricula

Most often mentioned as the subject area where curricula are expanding beyond the two-year norm are the engineering technologies.¹

While technical institutes have traditionally been the primary producers of technicians for the several engineering technologies, Junior Colleges are now conducting full-fledged technician programs though few (only one Junior College in California) are presently accredited by the Engineer's Council for Professional Development.

It is generally asserted that the education of the engineering technician requires increasingly higher levels of training which may affect the term of the curricula. "The increasing complexity of the education of engineering technicians has led at least three technical institutes to go from the typical two-year curriculum to three-year curriculum. This trend can probably be expected to continue."²

Harris notes that this increasing complexity creates the necessity for advanced-level courses in science, mathematics, electronics and engineering. As examples:

1. The electronics engineering technician needs some work in mathematics and circuitry which is ordinarily considered to be upper division work.
2. The chemical technician may need physical chemistry, bio-chemistry, spectrography--all upper division courses.

¹Specialties of engineering technicians may be classified to include:

Air conditioning, heating, and refrigeration engineer technologies
Aviation/Aerospace Engineering Technology
Building Construction Engineering Technology
Chemical Engineering Technology
Civil Engineering Technology
Electrical Engineering Technology
Electronics Engineering Technology
Industrial Engineering Technology
Instrumentation Technology
Internal Combustion Engines Engineering Technology
Mechanical Engineering Technology
Metallurgical Engineering Technology
Nuclear Engineering Technology
(ECPD, et al, Technician Career Opportunities in Engineering Technology, n.d.)

²Henry H. Armsby, "The Technician and the Engineering Team," Engineering Education, 57 (November 1966), p. 189.

3. The mechanical engineering technician may need thermodynamics, kinematics, strength of materials, and introduction to vector analysis.
4. The science research technician may need advanced (i.e. upper division) physics, micro-biology, etc.
5. Medical laboratory technology involves a number of upper division courses. [A four-year course is required for licensure in California.]

Obviously, even if the entering freshman student had no deficiencies to repair, he could not complete programs with this kind of content in two academic years. Perhaps by attending two summer sessions and four semesters, or by attending eight quarters he could be extruded through these programs in twenty-four months, but one wonders about the quality of such a concentrated, expedited program, as well as about the lost opportunity for summer employment in jobs related to the technology being studied.¹

The solution to the problem of complexity has been met not only by extending formerly two-year curricula to three years or five semesters, but baccalaureate programs are developing in engineering technology and the related industrial technology as well. These are being organized in all kinds of institutions.

There is no doubt that these two trends have caused considerable strain among technical educators. A subcommittee of the Engineers' Council for Professional Development (ECPD) in its final report on accreditation of four-year technology curricula reflects the concern:

It seems clear that unless criteria for accreditation of these programs are promptly adopted, considerable chaos could result. Engineering technology education, as ACPD has known it, is in jeopardy. It is being squeezed from below by two-year associate degree programs growing out of a vocational education background and is being outflanked at the four-year level by degree programs in technology evolving from an industrial arts heritage. Failure to act [by ECPD] will neither reverse these threatening trends nor, therefore, the growth in numbers of four-year technology programs. Procrastination can only rob these four-year technology programs of the guidance from ECPD which they will need to develop in a manner which best serves the needs of both technology and the engineering profession. The Committee further recommends closer liaison with industrial and governmental employers in helping to clarify the true role of technology.²

¹Letter to Council staff, June 30, 1967.

²Fifth Draft and Final Report of The ECPD Subcommittee on Four-Year Programs in Technology, H. E. McCallick, Chairman, January 31, 1966, p. 10.

The Engineering Technology Curricula

What makes a good engineering technology program? A publication of the AAJC suggests a course and semester credit hour requirement for Junior College curricula for semi-professional or engineering technicians as follows:¹

	<u>Credit Hours</u>
Mathematics (technical)--covering algebra, geometry, trigonometry, slide rule, analytical geometry, applied calculus and advanced topics	10
Science for the technician--covering applied physics, or chemistry, mechanics, thermodynamics, metallurgy, etc.	10
Technical specialty courses basic to the student's major--elementary and advanced; theory and practice	30
Supporting technical courses--graphics, engineering laboratory technical writing	6
General education courses--English, humanities, social studies, etc.	<u>18</u> 74

Completion of such a curricula of 74 units would probably take most students five semesters or more.² If remedial work is required, longer.

Curricula for training of technicians as a rule is not designed to parallel that required for the professional. Content and distribution of course work is intended to be more oriented to applied work, man skills, etc., than to concepts. A comparison of one two-year technology curricula with that of the first two years of an engineering program illustrates this point:³

¹Norman C. Harris, Technical Education in the Junior College/New Programs for New Jobs, (Washington, D. C.: American Association of Junior Colleges, 1964), p. 39. A number of general and specific curricula outlines are shown in this publication. Engineering technology curricula and those related as a rule range from 72-76 credit hours.

²This general curriculum is similar to that suggested by the American Society for Engineering Education in Characteristics of Excellence in Engineering Technology Education, (Urbana, Ill.: The Society, 1962), 46 pp.

³Henry H. Armsby, "The Technician and the Engineering Team," Engineering Education, 57 (November 1966), p. 188.

<u>Course</u>	<u>2-Year Mech. Tech. Prog.</u>	<u>Fresh-Soph Years, Mech. Engineering</u>
Specialized technical courses	32	4
Mathematics and science	18	46
Auxiliary and supporting technical courses	8	2
General education courses	<u>10</u>	<u>16</u>
	68	68

Ideally the course must be specifically tailored to the technician-in-training. For example, technical-level mathematics in a junior college will be taught at a slower pace and is less detailed or concept-oriented, than will be the math for the engineering transfer student. On the other hand, the depth required for technician students will be much greater than that for those seeking to enter vocations less closely allied to the professional level, but which do require some mathematical training.

For comparison purposes, the four-year, bachelor of technology mechanical engineering technology curricula recently designed for Oregon Technical Institute is shown. This Institute provides programs of two, three and now four years in length. (A person may progress directly from the Associate degree program to one of longer term if a 2.25 grade average is maintained.)

The Mechanical Engineering Technology curriculum prepares students for positions as engineering technicians in manufacturing and allied industries. As engineering technicians the graduates of the curriculum may participate in research which results in new products and methods; may help to design machines and equipment; may contribute to the manufacture of various products; or may apply and operate engineering and scientific equipment.

<u>FRESHMAN YEAR</u>	<u>Quarter Term Fours</u>		
	<u>F</u>	<u>W</u>	<u>S</u>
Introduction to Engineering	1	-	-
Engineering Drawing	4	4	-
Metals	3	3	-
Engineering Mechanics	-	3	3
Shop Processes	3	-	4
Physics	-	-	4
Mathematics	4	4	4
Introduction to Electronic Data Processing	-	3	-
Elective (3 non-technical)	-	-	2
Physical Education and Health	<u>1</u>	<u>1</u>	<u>1</u>
	16	18	18

	Quarter		
	Term	Hours	
<u>SOPHOMORE YEAR</u>	<u>F</u>	<u>S</u>	<u>S</u>
Mechanical Design	3	3	3
Manufacturing Processes	3	-	-
Fluid Power Systems	-	-	3
Electric-Electronic Fundamentals	-	4	-
Physics	-	4	4
English	3	3	3
Computer Programming	2	-	-
Electives (3 non-technical)	6	4	5
Physical Education and Health	<u>1</u>	<u>1</u>	<u>1</u>
	18	19	19

<u>JUNIOR YEAR</u>			
Industrial Psychology	3	-	-
Organization and Interpersonal Relations	-	3	-
Personnel Management	-	-	3
Social Science	3	3	3
Calculus	4	4	-
Managerial Accounting	-	-	4
Junior Research and Development Project	4	4	4
Elective	<u>3</u>	<u>3</u>	<u>3</u>
	17	17	17

<u>SENIOR YEAR</u>			
Administrative Processes	3	-	-
Production Concepts	-	3	-
Seminar in Administration	-	-	4
Statistics	3	-	-
Marketing	-	4	-
Labor Relations	-	-	3
Managerial Accounting	4	-	-
Advanced Technical Writing	-	3	-
Discussion Processes	-	-	3
Senior Research and Development Project	4	4	4
Elective (Arts & Sciences)	<u>3</u>	<u>3</u>	<u>3</u>
	17	17	17

This particular four-year technology curricula in large part consists of a two-year intensive technician program with an overlay in the junior and senior years of additional general education and business management-oriented courses. This sort of curriculum pattern is similar to that found in many of the technology baccalaureate programs in the California State Colleges.

Some individuals believe that today's four-year engineering technologies curricula are much similar in content to the professional engineering curricula of some years ago. They point out that as engineering has become more science-oriented and tasks of engineers more theoretical a gap has been produced which should be filled by highly trained technicians. (Options to this can be the employing of trained engineers in jobs which are below their capabilities.) Following this line of argument, the four-year baccalaureate programs in technologies are needed. This need increased as the basic professional training for the engineer approaches a five-year minimum.

Whether or not the five-year curriculum for the professional engineer will become the rule, and at what time, is a matter of major discussion. Statements of the Committee on Goals of Engineering Education of the American Society for Engineering Education reflect the active debate concerning the professional curriculum. The outcome over the coming years will influence, undoubtedly, the engineering technology curricula and the extent of time required for training for the engineering technician whether in Junior College or technical institute or four-year institution.

In some branches of engineering, the baccalaureate program has been lengthened to five years as a regular requirement, and at a few institutions this practice has been extended to engineering programs in general. In some cases, the growing demands of technological specialization have been met by an increasing use of on-the-job or professional training within industry. In a number of areas, there has been increased recognition of the need for graduate study, especially for those students who are preparing themselves for occupations in research and development, or in fields where new knowledge is being rapidly developed. In a few fields of engineering practice, it is felt by both educators and employers of engineers that the current four-year program is adequate for their needs and will remain so in the foreseeable future. In short, it seems evident that we are witnessing a trend toward a new kind of diversity in engineering education--a diversity which is likely to increase as new technologies develop and older ones change in character.

* * *

What seems to be happening is that from every quarter--practicing engineers, employers of engineering talent, educators, and students themselves--pressure is being exerted to raise the level of basic engineering education and to include in the preparation for general engineering practice not merely additional undergraduate courses but at least a year of training at the graduate level--in short, to increase the generally accepted academic requirements for entry into the engineering profession. There is little doubt that during the next decade we will witness a rapidly developing consensus that the master's degree should be considered the basic professional degree in engineering.¹

¹Interim Report of the Committee, April 1967, pp. 7-8.

Remedial Work

While complexity and demands of a sophisticated technological society may be causing the extension of Junior College curricula in engineering technologies, the most important variable in the need to extend curricula may be the remedial work required to bring the entering Junior College student up to the level of entry into the technician curriculum.

It is suggested by some that it is the need to make allowance for remedial work which tends to extend the Junior College curricula. In the engineering technologies the level of mathematics required is relatively high. In order for students to function at this level, the high school grounding must be sufficient, or the Junior College must allow for remedying the deficiency. It would appear that remedial work should not be considered a part of the curriculum unless most students are similarly deficient. The remedial course then becomes an element of the curriculum at least de facto.

The Student

The need for remedial work is closely related to the kind of student best adapted to the technician program.

Some writers suggest that the "middle-level" student is best fitted to the technician program (or vice versa). Most technical educators interviewed in Junior Colleges agree that those students who are capable of pursuing professional engineering work should immediately do so, and follow a pre-engineering, college transfer curricula. Some students, of course, will complete a technology curricula and then go on to successfully pursue a four, or five-year, college program in engineering or the like, but this number is presumed to be small if abilities are being taken into account for training at appropriate levels.

Complicating the direction of the student to the curriculum best fitted to his abilities is the emphasis placed upon obtaining a baccalaureate degree by most people. Assuming this emphasis continues, then two possibilities will occur--likely both at the same time. First, less able students will be entering terminal, technology programs as more and more of the able students seek transfer curricula at the outset. And second, of those completing the technician program, there will be an increase in attempts to transfer terminal work toward four-year programs. Related to the latter, is the apparent trend toward development of four-year technology curricula.

Meeting these divergent trends is not an easy task. Implicit in the problem, and most important, is the premium which industry as the employer may or may not place upon the training received and degrees or certificates awarded in the course of that training. Again industry should state as concisely as possible the training needed for entry level.

The use of testing on entrance and assessments of extent of interest and aptitude play an important role in determining who will be the successful student and become the trained technician. Careful evaluation is probably essential to running a good program in a Junior College. It is likely that the engineering technologies typically make the greatest use of evaluation tools for individuals entering the curriculum.¹

Some Junior College educators in California express concern over the opportunities open to students to transfer after successful completion of technical curricula. Though there may be a number of problems in transferring of students in the engineering technologies, the problem is likely not of the magnitude of the problem facing the registered nurse who as a graduate of an association degree program and who seeks to obtain the baccalaureate degree.

Summary

A review of the engineering technologies in the Junior Colleges suggests that no clear trends are apparent toward the possible expansion of curricula to formally recognize a third year of work. The four-year program in technology appears to be a more significant trend, and likely will work to discourage the need for an extended Junior College program.

The engineering technology curricula exhibit reflections of professional aspirations. The technician, though achieving a separate identity from the professional at one pole and the skilled craftsman at the other, is still not uniformly recognized, nor is the extent of training he needs to perform at the entry level fully spelled out by the industry or the associations of practitioners.

It appears industry itself has not, apparently, arrived at conclusions as to what it expects of the technicians in engineering-related skills.

The review also suggests the conclusion that societal pressures placing heavy emphasis on the baccalaureate degree may be leading individuals away from terminal technology programs.

The review of the engineering technologies has implications for other technical areas. Problems of professionalization, definition of the extent to which the potential employer or industry should train to greater technical competence, the needed training for minimum entry level, the source and abilities of students are all suggested. These implications for Junior Colleges are discussed below.

¹The importance of interest, as well as ability, is supported in Louis M. Herman and Martin L. Zeigler, "Comparison of Academic Achievement, Aptitudes, and Interest Patterns of Two-Year Technical Students and Four-Year Degree Candidates in Engineering," Journal of Experimental Education, 29 (September 1960), 81-7.

Implications of Extended Junior College Curricula

Erosion of the Two-Year College Concept

The Junior College is generally perceived as a "two-year" institution which implies that a typical Junior College student attending full-time with adequate high school preparation in most cases will be able to complete a given curricula in two years--or less in some vocational program subject areas. Recognition and encouragement of curricula extending beyond the two-year basic curricula organization would likely confuse the purpose and objectives of Junior Colleges as two-year, comprehensive community colleges.

Junior Colleges as we know them in California are not specialized institutes. They attempt to encompass within one institution a variety of technical-vocational, transfer and general education curricula. What may be appropriate for certain kinds of specialized programs, may not be for the Junior College. Thus Junior Colleges may not be easily able to formally recognize numbers of three-year curricula, even in specialized areas should they be required.

The Need for Adaptation

While a formal recognition of extended curricula is not necessary, there does appear a need for accommodation of the demands of certain occupational training areas within the curricula which do require extended curricula. The clinical training in nursing, for example, is considered an adjunct to institutional instruction. Similarly in X-ray technology. Remedial work required to bring students up to the entry level of a curriculum may be considered apart from the normal two-year program and not a common need of all students entering that curriculum.

The tendency of curricula expansion beyond the two-year "ideal" carries with it two aspects of concern which have been recognized in the several statewide surveys of higher education in California, beginning with the 1947 Strayer report. First, extension of curricula may encourage Junior Colleges to become four-year, degree-granting institutions--if only in specialized areas. This has been opposed among California Junior College leaders yet continued expansion of curricula may tend to encourage this possibility.

Secondly, expansion of curricula beyond two-years in term may lead to questions as to the point when the 14th grade level of instruction is exceeded. Additional depth at the levels identified with the first two years of college is considered appropriate, but the providing of courses equivalent to the junior year of a professional program is not allowed by statute.

Continuing Education and Extension of Curricula

The technologically-oriented society of today requires extensive formal and informal continuing education for all ages of its working force. Higher education institutions are now only beginning development of major programs

to meet this continuing education need. To date, the individual in need of up-grading or retraining in new and more sophisticated skills has tended on his own to seek out evening courses or the like to meet his needs.

In technical-vocational subjects, continuing education may be a better answer than curriculum extension. Within this view, programs designed to provide the basic minimum for entry level work may be accomplished within no more than the equivalent of the initial two-years of full-time college attendance. The individual, then, after entering employment, may return for training in more sophisticated skills or retraining as is needed (similar training would also be conducted within the industry). This training should be geared to the experience level of the individuals continuing their education.

The Cost Factor

Extension of Junior College curricula in term appears most likely in training programs for technicians, and these programs typically are more costly per student than most transfer curricula or general education programs. Certainly development of such technical curricula must occur only with the realization of the total costs of providing sufficient laboratory and working equipment to assure the training of a quality product.¹

From comments of individuals interviewed in the preparation of this review, it appears that at present there is limited encouragement of inter-district transfer of students among technical-vocational programs, high cost or otherwise. (There are, however, some notable exceptions.) As suggested in a recent report of the Council, such efforts could well take place in agricultural programs. It is likely that detailed study in specific technical-vocational subjects would show that similar efforts could be made in respect to those technical-vocational programs where enrollment potential is too low for a district to carry on a good program. If students from other districts were encouraged to attend the program in one district it might become more economically feasible, and provide more opportunity for greater numbers of students.

While Junior Colleges are community-oriented, they may best serve their community by working with other districts in arranging for exchanges of students with interest and capability for training in certain specialized programs. (Some efforts have been made along this line, such as the Cabrillo-Hartnell-Monterey Peninsula College programs developed in cooperation to avoid duplication. Multi-campus districts also have defined functions to meet this end.)

¹Qualified instructors may be difficult to obtain as well. The good technician may not be grounded sufficiently to teach the needed scientific background. On the other hand, the person with theoretical background may not be sufficiently interested or able to instruct at the technician level.

Junior college technician programs should be considered in reference to the four-year technology curricula such as that of industrial technology offered in a number of institutions. Cal Poly (S.L.O.), Fresno, Long Beach, San Francisco, and now Chico State Colleges have industrial technology programs. These programs may be designed primarily for junior college transfers. Long Beach, for example, depends exclusively on junior college transfer students in its industrial technology program.

The baccalaureate programs offer an opportunity for the more able graduates of technical programs at the Junior College level to receive four-year degrees. At the same time, unless designed only for transfers, the baccalaureate programs may serve to drain-off higher ability students from Junior Colleges who might otherwise complete a two-year curricula and then transfer on.

As noted elsewhere, most persons agree that the four-year technology program is more a trend of the future than the three-year curriculum. The opportunity to give advanced management and supervisory training in the upper division, as well as additional advanced technical instruction are features of the baccalaureate curricula. To date industry has tended to place a premium on the four-year degree.

Junior college technical curricula are normally considered as "non-transfer". The existence of four-year technology programs, however, suggest that at least for some students, the technical courses taken in a Junior College program are transferable. The ability to transfer such work depends upon agreements between the two-year institution and the four-year college. The four-year college, for example, may encourage attendance in Junior Colleges where extensive equipment and facilities exist to avoid duplicating them in the four-year institution. The bulk of the practical experience, then, may be provided in the freshman and sophomore years, as programs such as management training, etc., are given in the junior and senior years.

Findings

This review suggests a number of general findings as follows:

1. There appear to be no significant and clear trends toward extending Junior College curricula beyond the typical two-year curriculum pattern.
2. However, some tendencies to lengthen curricula in technical subject areas are noted. These result, in part, from efforts by accrediting associations, professional groups, and state or federal agencies, to specify and up-grade qualifications for entry-level into particular occupational classifications. This specification for entry qualification may take the form of a professional certification or licensure. These efforts to improve status and quality will likely continue.

3. The role of the employer in curriculum development is important; however, in most instances minimum requirements for entry-level have not been specified concisely.
4. Four-year technology programs appear to be increasing in number nationally. This trend may continue.

APPENDIX A

A number of individuals have contributed to the material within this report.

The following gave freely of their time in interviews in California:

Mr. C. J. Aggeler
Division of Engineering
San Francisco City College

Mr. Leland Baldwin
Chief, Bureau of Technical
Vocational Education

Mr. Joseph Berkley
Chairman, Division of Engineering
Sacramento City College

Mr. Fred J. Brinkman
Dean, Los Angeles
Trade Technical College

Dr. Douglas Burris
Dean of Instruction
American River J. C.
(Also staff member AAJC
Occupational Education Project)

Mr. Gerald Cresci
Assistant Chief, Bureau of
Technical Education
Department of Education

Dr. Thomas Dean
Dean, Industrial Technology
Long Beach State College

Mr. Robert D. England
Department of Public Health

Mr. Franklin Johnson
Dean of Instruction Curriculum
Los Angeles Trade Technical College

Miss Edith V. Krabach
Health Education Consultant
Department of Public Health

Mrs. Barbara Lafferty
Head, Nursing Program
Sacramento City College

Mr. Lloyd Messersmith
Executive Secretary
California Junior College

Dean Thomas Nesbitt
Dean of Instruction
San Francisco City College

Mr. James F. Schon
Chairman, Division of Engineering
Sacramento City College

Mr. Eugene Wood Smith
President, Cogswell
Polytechnic College

Mr. F. Parker Wilbur
President
Los Angeles Trade Technical College

Mr. Filloyd Younger
Dean of Instruction
Cabrillo College

The following individuals were interviewed by the Council's Washington representative, Mr. Norman Gould.

Mr. W. Latin Collins
Executive Secretary
American Association for
Engineering Education
Washington, D. C.

Dr. Merrill De Long
Allied Health Training Section
Department of Health, Education
and Welfare

Mr. Paul Robbins
Executive Director, National
Association for Professors of
Engineering

Dr. William Shannon
American Association of Junior Colleges

Mr. Kenneth Skaggs
American Association of Junior Colleges
(Staff member AAJC Occupational
Education Project)

Mr. Grant Venn
Chief, Bureau of Vocational Technical
Education
U. S. Office of Education

Special recognition must be given Mr. Norman C. Harris, Professor of Technical Education, Center for the Study of Higher Education, University of Michigan. Dr. Harris provided the staff with a most detailed statement on the question under study which is quoted in part.

Responsibility for the following and interpretations made, of course, lie with the Council staff.